MONTHLY NOTICES

OF THE

ROYAL ASTRONOMICAL SOCIETY.

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W. H. M. CHRISTIE, M.A., F.R.S., President, in the Chair.

Edward Carpmael, B.A., The Ivies, St. Julian's Farm Road, West Norwood, S.E.;
James George Petrie, 15 Mercer's Road, Holloway, N.,

were balloted for and duly elected Fellows of the Society.

The following candidates were proposed as Fellows of the Society, the name of the proposer from personal knowledge being appended:—

Richard Evan Day, M.A., Lecturer on Nautical Astronomy at the Birkbeck Institute, 48 Belsize Square, N.W. (proposed by the Rev. A. L. Watherston);
Philip F. Duke, Journalist, Hendon, Middlesex (proposed by the Rev. S. J. Perry);
The Rev. Thomas Jones, B.A., LL.D., Rector of Curdworth, Warwickshire (proposed by Professor J. C. Adams);
James Oddie, J.P., F.G.S., F.R.G.S., School of Mines, Ballarat, Victoria (proposed by A. Cowper Ranyard).

The following were proposed by the Council as Foreign Associates:—

S. C. Chandler, Cambridge, Mass., U.S.A.;
N. C. Dunér, Observatory, Lund, Sweden;
Paul Henry, Observatory, Paris;
Prosper Henry, Observatory, Paris.

Mean Areas and Heliographic Latitudes of Sun-spots, 1874 to 1888, deduced from Photographs taken at Greenwich, at Dehra Dûn (India), and in Mauritius.

(*Communicated by the Astronomer Royal.*)

The following tables give the results of the measurements of solar photographs taken at the Royal Observatory, Greenwich, at Dehra Dûn, India, and at the Royal Alfred Observatory, Mauritius, for each synodic rotation of the Sun in 1888, and for each year from the commencement of the Greenwich series. The Indian series of Sun pictures used in these measurements begins on 1881 December 22, and the Mauritius series on 1885 January 3. The daily photographic record is practically complete from the beginning of 1882.

Table I. gives the mean daily areas of umbræ, whole spots, and faculæ for each synodic rotation of the Sun in 1888. The areas are given in two forms: first, projected areas—that is, as seen and measured on the photographs, these being expressed in millionths of the Sun's apparent disk; and next, areas as corrected for foreshortening, the areas in this case being expressed in millionths of the Sun's visible hemisphere. Table II. gives the mean daily areas (corrected for foreshortening) for each year from the commencement of the Greenwich series, and the projected areas for the years 1882 to 1888, the projected areas for the years preceding 1882 not having yet been computed. Table III. exhibits for each rotation in 1888 the mean daily area of whole spots, and the mean heliographic latitude of the spotted area, for spots north and for spots south of the equator, together with the mean heliographic latitude of the entire spotted area, and the mean distance from the equator of all spots. Table IV. gives the same information for each year from 1874 to 1888.

TABLE I.

No. of Rotation.	Date of Commencement of each Rotation.	No. of days on which Photographs were taken.	Mean of Daily Areas. Projected. Umbræ.	Whole Spots.	Faculæ.	Corrected for Foreshortening. Umbræ.	Whole Spots.	Faculæ.
458	1887 December 26·77	26	33	202	366	24	145	462
459	1888 January 23·11	27	3	14	205	3	15	255
460	February 19·45	26	37	243	219	24	157	262
461	March 17·77	27	5	37	279	5	34	299
462	April 14·06	26	5	29	190	4	26	223
463	May 11·30	28	50	276	203	37	206	226
464	June 7·51	27	7	58	305	5	36	326
465	July 4·71	27	4	30	177	3	25	214
466	July 31·91	27	4	28	130	3	20	158
467	August 28·15	28	31	208	235	23	152	279
468	September 24·42	27	2	19	120	1	8	143
469	October 21·71	27	51	304	120	34	205	135
470	November 18·01	26	36	204	216	24	143	234

The rotations in the above table are numbered in continuation of Carrington's series (Observations of Solar Spots made at Redhill by R. C. Carrington, F.R.S.), No. 1 being the rotation commencing 1853 November 9. The assumed prime meridian is that which passed through the ascending node at mean noon on 1854 January 1, and the assumed period of the Sun's sidereal rotation is 25·38 days. The dates of the commencement of the rotations are given in Greenwich Civil Time, reckoning from mean midnight.

Table II.

Year.	No. of days on which Photographs were taken.	Mean of Daily Areas.					
		Projected.			Corrected for Foreshortening.		
		Umbræ.	Whole Spots.	Faculæ.	Umbræ.	Whole Spots.	Faculæ.
1873	58	...	...	...	120	701	3401
1874	159	...	...	...	85	601	813
1875	161	...	...	...	48	272	451
1876	162	...	...	...	25	122	256
1877	168	...	...	...	19	92	175
1878	146	...	...	...	5	24	90
1879	126	...	...	...	11	49	151
1880	158	...	...	...	85	416	977
1881	181	...	...	...	149	730	1733
1882	343	254	1339	2033	189	1002	2154
1883	340	283	1556	1592	175	1155	1856
1884	315	172	1304	1501	148	1079	2057
1885	354	146	1136	1250	101	811	1496
1886	363	71	527	473	50	381	579
1887	361	37	243	256	26	179	301
1888	358	20	126	204	14	89	236

The Means of Daily Areas for the year 1873 refer to a period of about five months commencing 1873 July 28.

Many of the photographs taken during the early part of 1874 do not show the faculæ with sufficient distinctness to allow of their measurement. The mean of daily areas of faculæ for the half-year beginning 1874 June 20 is 1102.

TABLE III.

No. of Rotation.	Date of Commencement of each Rotation.	No. of days on which Photographs were taken.	Spots North of the Equator. Mean of Daily Areas.	Spots North of the Equator. Mean Heliographic Latitude.	Spots South of the Equator. Mean of Daily Areas.	Spots South of the Equator. Mean Heliographic Latitude.	Mean Heliographic Latitude of entire Spotted Area.	Mean Distance from Equator of all Spots.
				°		°	°	°
458	1887 December 26·77	26	11	+ 2·65	134	−8·50	−7·65	8·06
459	1888 January 23·11	27	0	...	15	−5·10	−5·10	5·10
460	February 19·45	26	66	+ 2·99	91	−4·66	−1·46	3·96
461	March 17·77	27	23	+ 3·18	11	−8·61	−0·61	4·93
462	April 14·06	26	0	...	26	−7·48	−7·48	7·48
463	May 11·30	28	0	...	206	−8·01	−8·01	8·01
464	June 7·51	27	15	+ 4·75	22	−6·15	−1·74	5·59
465	July 4·71	27	2	+ 5·95	24	−9·80	−8·65	9·52
466	July 31·91	27	4	+ 7·48	16	−4·07	−1·99	4·68
467	August 28·15	28	2	+ 5·03	150	−7·25	−7·10	7·22
468	September 24·42	27	0	+ 1·95	8	−5·62	−5·58	5·60
469	October 21·71	27	141	+10·20	65	−4·07	+5·71	8·27
470	November 18·01	26	0	...	143	−9·98	−9·98	9·98

TABLE IV.

Year.	No. of days on which Photographs were taken.	Spots North of the Equator. Mean of Daily Areas.	Spots North of the Equator. Mean Heliographic Latitude.	Spots South of the Equator. Mean of Daily Areas.	Spots South of the Equator. Mean Heliographic Latitude.	Mean Heliographic Latitude of entire Spotted Area.	Mean Distance from Equator of all Spots.
			°		°	°	°
1874	132	275	+ 9·01	362	−12·18	−3·03	10·81
1875	161	153	+11·16	119	− 9·46	+1·99	10·58
1876	162	32	+12·58	90	−10·91	−4·66	11·35
1877	168	26	+ 9·12	65	− 9·51	−4·18	9·40
1878	146	24	+ 7·14	1	− 8·09	+6·92	7·15
1879	126	14	+23·59	35	−22·51	−9·18	22·82
1880	158	257	+20·01	159	−19·45	+4·90	19·80
1881	181	500	+18·17	229	−18·29	+6·70	18·21
1882	343	443	+15·99	558	−19·26	−3·67	17·81
1883	340	340	+10·99	815	−13·90	−6·57	13·04
1884	315	478	+10·67	601	−11·74	−1·82	11·27
1885	354	283	+10·54	528	−12·41	−4·40	11·76
1886	363	76	+ 9·93	305	−10·50	−6·42	10·38
1887	361	44	+ 8·75	134	− 8·34	−4·09	8·44
1888	358	20	+ 7·10	69	− 7·48	−4·22	7·39

The Means of Daily Areas, &c., in Table IV. for the year 1874, refer to a period of eight months from 1874 April 27, to 1874 December 28.

The foregoing tables would appear to indicate that the Sun-spot minimum is now close at hand; for the mean daily area of Sun-spots for the year 1888 was slightly smaller than for the year 1877, and the period of complete quiet at the last minimum commenced in November 1878, so that supposing the present decline to follow precisely the precedent of the last, the minimum would take place before the close of the present year. The distribution of the spots in latitude points to a similar conclusion, for the mean distance from the equator of all spots for 1888 is almost as small as for the year 1878. A further indication in the same direction has already been pointed out by the Rev. S. J. Perry (*Nature*, vol. xxxix. p. 223). In previous cycles it has often occurred, as Professor Spoerer has pointed out, that, whilst during the decline to minimum the mean distance from the equator of all spots has steadily decreased, the fact that the minimum has been passed has been signalised by the appearance of a spot in a high latitude. On 1888 December 30, a small faint spot was observed in 36° S. latitude. It was, indeed, a very small and evanescent spot; it had not formed at $5^h\ 51^m$ Greenwich Civil Time, when the daily photograph of the Sun was taken at Dehra Dûn; but it was fairly conspicuous at $10^h\ 35^m$ G.C.T., when it was seen and drawn at Stonyhurst College Observatory. It was still visible though very small and faint at $13^h\ 5^m$ G.C.T., when a photograph was taken at the Royal Observatory, Greenwich, but it had wholly disappeared before the next day.

Table IV. brings out the remarkable predominance as to spotted area which the southern hemisphere has shown over the northern during the last seven years. From 1874 to 1881, sometimes the one hemisphere and sometimes the other appeared the more prolific, but on the whole the spots were very evenly divided between the two. In 1881 the mean spotted area north was more than double the mean area south, but in April 1882 there was a very remarkable outburst in the southern hemisphere which transferred the predominance to that region. In November of the same year the largest single spot of the present cycle appeared in the northern hemisphere, and the balance was again shifted, but after its disappearance the southern hemisphere has been almost invariably the richer of the two; indeed, for the total of the last six years the area south has been very nearly double that of the area north, and whilst many rotations have been entirely barren of spots north of the equator, that has never been the case south. Corresponding to this inferiority in extent of spotted area for the northern hemisphere has been a similar inferiority in mean latitude; the mean latitude of the southern spots being considerably greater than of the northern for each year from 1882 to 1888, with the single exception of 1887.

Royal Observatory, Greenwich:
1889 *May* 9.

Note on an Error in Le Verrier's "Tables du Soleil."

By R. T. A. Innes.

There is a small error in Le Verrier's Tables of the Sun (*Les Annales*, vol. iv.) which, as far as I am aware, seems to have escaped detection.

In the expression for R on p. 103 the same variation of the excentricity is used as on p. 54, viz.:—

$$-0{\cdot}000{,}000{,}4338$$

instead of

$$-0{\cdot}000{,}000{,}4244$$

resulting from $-0''{\cdot}08755$ on p. 102.

In calculating R especially for a distant epoch it will be worth while to take this correction into account.

In vol. xl. p. 598 of the *Monthly Notices*, Sir G. B. Airy puts

$$\frac{\text{Variation of E for 1 year}}{\text{E}} = -\frac{{\cdot}0000004338}{{\cdot}01676927};$$

this should be

$$-\frac{{\cdot}0000004244}{{\cdot}01677106}.$$

This changes the value of the lunar acceleration from

$$5''{\cdot}4773 \text{ to } 5''{\cdot}3587.$$

The two following tables will enable the correction to be applied during the time covered by Le Verrier's Tables.

Le Verrier's Tables of the Sun. Section V. Table XXXII.

The seventh decimal place taken for unity.

Mean Anomaly.		Correction to Var. Séc. Natl. No.	Logarn.	Mean Anomaly.	
0	360	−9·3+	−4·0+	180	180
5	355	−9·3+	−4·0+	175	185
10	350	−9·2+	−4·0+	170	190
15	345	−9·0+	−3·9+	165	195
20	340	−8·7+	−3·8+	160	200
25	335	−8·4+	−3·7+	155	205
30	330	−8·1+	−3·5+	150	210
35	325	−7·6+	−3·3+	145	215
40	320	−7·1+	−3·1+	140	220
45	315	−6·6+	−2·9+	135	225
50	310	−6·0+	−2·6+	130	230

Mean Anomaly.		Correction to Var. Séc. Natl. No.	Logarm.	Mean Anomaly.	
55	305	−5·3+	−2·3+	125	235
60	300	−4·6+	−2·0+	120	240
65	295	−3·9+	−1·7+	115	245
70	290	−3·2+	−1·4+	110	250
75	285	−2·4+	−1·1+	105	255
80	280	−1·6+	−0·7+	100	260
85	275	−0·8+	−0·3+	95	265
90	270	−0·0+	−0·0+	90	270

Section VI. Table II.

Correction to R.

Sun's Longitude.		1860.	1870.	1880.	1890.	1900.	Sun's Longitude.	
280	280	−0·9+	−1·9+	−2·8+	−3·7+	−4·6+	100	100
290	270	−0·9+	−1·8+	−2·8+	−3·7+	−4·6+	90	110
300	260	−0·9+	−1·7+	−2·6+	−3·5+	−4·3+	80	120
310	250	−0·8+	−1·6+	−2·4+	−3·2+	−4·0+	70	130
320	240	−0·7+	−1·4+	−2·3+	−2·8+	−3·5+	60	140
330	230	−0·6+	−1·2+	−2·0+	−2·4+	−3·0+	50	150
340	220	−0·5+	−0·9+	−1·6+	−1·8+	−2·3+	40	160
350	210	−0·3+	−0·6+	−1·2+	−1·3+	−1·6+	30	170
360	200	−0·2+	−0·3+	−0·5+	−0·6+	−0·8+	20	180
10	190	−0·0	−0·0+	−0·0+	−0·0+	−0·0+	10	190

Extract from a letter from Professor J. C. Adams to Mr. Knobel.

'Mr. Innes is quite right in pointing out that the variation of the excentricity in the expression of the radius vector does not agree with that given in the definitive value adopted for the equation of the centre. It really agrees with the value of the variation of the excentricity given in page 53, which is that which is consistent with the masses of the planets which are assumed in page 49. The correction of the annual variation of the excentricity is given in page 55, in terms of the corrections of the planetary masses. The values of $2\delta e$ which result from the observations, chiefly those of Greenwich, are given on page 89, and these indicate a smaller value of the variation of the excentricity than that employed in the original theory.'

Parallel Photographs of the Spectra of the Sun, of Iron, and of Iridium, from the Line (H) *to near the Line* (D), *in six sections. Also separate Photographs of the Spectrum of Titanic Iron Ore, in six sections.* By Frank M'Clean, M.A.

The photographs of the solar and metallic spectra now brought before the Society follow the same scheme as the "Photographs of the red end of the Solar Spectrum," presented by the writer in December 1888.

The division into sections and the scale (approximately) are the same as in Ångström's Normal Solar Spectrum. This plan has the advantage of always presenting the spectra in the same familiar divisions, and also of rendering these divisions suitable for direct comparison with Ångstrom's chart.

The present photographs comprise, in the first place, the first six sections of the solar spectrum numbered I. to VI. Taken along with the seven sections comprised in the "red end of the solar spectrum" previously given, and numbered 7 to 13, they complete the whole visible solar spectrum, from (H) to (A).

The present six sections of the solar spectrum are accompanied by corresponding and parallel photographs of the spectra of metallic iron, and of metallic iridium.

The iridium spectrum was fixed upon in order to obtain a full spark spectrum of air, for purposes of comparison. It shows Kirchhoff's iridium lines at wave-lengths 5299 and 5450. It also shows other unregistered lines, either of iridium or of air, which however can only be identified correctly when photographs of further spectra have been obtained. The air lines are present, more or less distinctly, in all spark spectra taken in air, and they supply a ready and accurate means of co-ordinating such spectra with the iron spectrum and with each other.

The iron spectrum was fixed upon on account of its close correspondence throughout with the spectrum of the Sun, and its thus furnishing the best means of co-ordinating the spectra of the other metals with the solar spectrum. The reference of the metallic spectra to the scale of wave-lengths established by Ångström's Normal Solar Spectrum is thus obtained, and it should be borne in mind that Ångström's spectrum is the only complete spectrum of any kind which has been determined to the scale of wave-lengths by direct observation.

It should be remembered that the photographs are only suitable for filling in the details of the spectra between the standard reference lines. Neither the spectroscope used nor the photographic impression is suitable for the accurate measurement of the angle of divergence between the standard lines themselves. A much more compact spectroscope with graduations and adjustments of the most perfect character would be absolutely necessary for such a purpose. The radical difference between measure-

ments within the field of view and independent measurements of direction is involved. The want of rigidity scarcely avoidable with the long tubes of a spectroscope suitable for photography, although comparatively immaterial in the first case, would be fatal where the observation must be made along the line of collimation of the telescope and the direction accurately determined.

Thalén's determinations of the wave-lengths of the metallic spectra, which accompany Ångström's chart, were not made with a diffraction spectroscope. They were, in fact, Kirchhoff's and Hofmann's determinations of the metallic spectra, and were made with a refraction spectroscope to "Kirchhoff's scale." Thalén transformed them to wave-lengths by means of interpolation, on a curve drawn through a large number of points, whose abscissæ represented the wave-lengths of the lines of Ångström's solar spectrum.

Dr. Huggins' determinations of the "Spectra of the Chemical Elements" were also made with a refraction spectroscope. He proceeded by referring the observed spectrum to the lines of the air spectrum as lines of reference. The measurements were taken to the graduated scale of his own instrument. He determined the position of the principal lines of the solar spectrum to the same scale, but, being foreign to his purpose, he did not establish any more detailed connection between the spectra of the chemical elements and the solar spectrum. There seems, therefore, to be an opportunity for the co-ordination of the metallic spectra, by means of the direct comparison of photographs taken with the diffraction spectroscope, with Ångström's standard wave-length chart of the solar spectrum. The writer purposes, if possible, to continue the present series of photographs of the metallic spectra with this object in view.

The striking coincidence of the spectrum of iron with the solar spectrum is of course well known. But to many it is only hearsay knowledge. The present photographs display it to the eye itself, and they carry with them a conviction due to their being the self-recorded images of the phenomena themselves. Attention may be directed to Section V. as particularly rich in coincidences, including the double (E) line with components under one tenth-metre apart. The curious double character of nearly all lines at the violet end of the spectrum is shown in Sections I. and II., although on reaching (H) the definition of the spectroscope somewhat fails.

The same six sections of photographs of the spectrum taken between electrodes of iron and ilmenite (or titanic iron ore), mounted on loose slips, accompany the bound photographs, in order to illustrate the way in which the photographs can be compared with each other, and with Ångström's chart. If Section IV. of these slips be compared with Ångström's, the presence in the titanic iron ore, of titanium, chromium, cobalt, and calcium, is at once apparent. Magnesium and barium are also

shown by other sections. The same specimen of ore has unfortunately not been used for all the sections.

It is hoped eventually to extend the metallic spectra to three further sections, thus including the Fraunhofer line (C). But as this must be a much more laborious undertaking it has been for the present postponed.

As before, the photographs have been taken with a Rutherford grating ruled 17,296 lines to the inch, and about $1\frac{3}{4}$ inch square, and they have been enlarged from the original negative about $8\frac{1}{2}$ times.

The writer is unaware of any photographs of the metallic spectra, below the (H) group of lines in the violet, having hitherto been produced to the large scale of the present photographs.

The photographs which accompany the Paper have been placed in the Library.

Note on Terby's White Spot on the Ring of Saturn.
By A. A. Common, F.R.S.

On March 6, at 9.12 P.M., Dr. Terby at Louvain, using his 8-inch telescope, saw what he announced as a white spot on the ring of *Saturn* near the shadow of the planet. Subsequent observations confirmed this appearance to him, and since his observations were announced other observers in different parts of the world have been able to see a white spot on the rings.

On March 6 the 5-foot reflector at Ealing was in use on *Saturn* for several hours, including the time at which Dr. Terby first saw this white spot. Details of the markings on the planet and rings were noted, special attention was paid to the shadow (of the planet), which was seen to be irregular in outline, but nothing in the nature of a bright spot near it was noticed. The positions of the satellites were noted at 9 o'clock, and at 9.30 it was noted that *Mimas* was visible, although not clear of the ring in either case. The first information received at Ealing of Terby's white spot was a telegram from Aberdeen on March 14. "Terby announces région blanche sur anneau *Saturne*, contre ombre globe." Next day *Saturn* was observed with the 5-foot; the white spot was specially looked for, the ring was carefully examined all over, but nothing unusual could be made out. *Saturn* has been observed on ten other evenings since then by Mr. Taylor and by myself, but in no case has any definite white spot been seen.

The ring near the shadow always appears slightly brighter by contrast than the other portions of the ring do; and this effect is found to be much more marked with the 6-inch refractor than with the 5-foot reflector. A dark wedge has been used on many occasions since March 14 by Mr. Taylor and myself on the 6-inch telescope and on the 5-foot, and in every case we have

found that the ring disappears at the same time all round, whereas if the white spot had any real existence (*i.e.* if it were really brighter than the other parts of the ring), it would have remained visible after the other portions of the ring had been cut out by the dark wedge. The appearance of increase of brightness can be produced with either the 6-inch refractor or the 5-foot reflector, on any part of the planet, at any time, by allowing it to pass partly out of the field when all parts of the ball and ring in immediate contact with the edge appear sensibly brighter than the rest of the planet. At the Lick Observatory, with an occulting bar on the 36-inch refractor, a similar effect was noticed at the edges of the bar.

The contrast appearance which is seen near the shadow of the planet on the ring is sometimes more obvious than at others, but atmospheric irregularities will explain much of this suspected variability. It is remarkable that such careful observers as Bond and others who have worked on *Saturn* should not have called attention to this appearance before, but it will probably be found much more prominent in certain positions of the planet and rings than in others.

The powers used have varied considerably; 300 has been generally used on the 6-inch, and as much as 1400 on the 5-foot. With the latter power the shadow has a decidedly notched appearance, the outer and brighter part of the middle ring (B) projecting farther into the shadow than any other part of the ring, although the outer ring (A) is closer to the planet than one would expect from the outline of the shadow on the inner portions of the ring. It may be that this notched appearance, which is only distinctly visible with very high powers, may have some connection with the appearance to which Dr. Terby directed attention, but the observations made at Ealing very decidedly point to the explanation of the supposed white region as an effect of contrast.

Saturn was photographed several times with the 5-foot in April. Although definition in the photographs is not good, the shadow can easily be made out by the absence of silver particles, but there are not the slightest indications of any bright spot on the rings near the shadow.

Photograph of the Nebula M 51 Canum Venaticorum.
By Isaac Roberts.

The photograph which is now presented is an enlargement to ten times the negative of M 51 *Canum Venaticorum*, R.A. $13^h\ 25^m$, D. $+47°\ 45'$. The negative was taken on April 28, 1889, with an exposure of four hours, and it adds considerably to our knowledge of the structure and the surroundings in space of this

nebula, and I think that it will be generally accepted as a demonstration of the truth of the nebular or of the meteoric hypothesis.

The nebula is well known by the numerous drawings and descriptions of it, particularly those by Herschel, Rosse, and Lassell.

The drawing by Lassell * agrees well in general outline with the photograph, and I must bear testimony to the fact that Lassell's drawings of other nebulæ also generally agree more closely with the photographs than do those of any other delineator that have come under my notice. But all drawings alike fail to present to the eye proportions, details, and outlines as they are shown on the photographs.

Referring now to the photograph before us, we see much more than the spiral form of a nebula with apparently two distant nuclei, for we see that the spirals have broken up at relatively short intervals into stars which are either coincident with, or very closely follow, all the convolutions of the spiral. The coincidence of the stars with the trend of the spiral from the nucleus to the farthest whorls of the nebulous stream is remarkable, and the condensation of the nebulous, or shall we say agglomeration of the meteoric matter into stars, is so striking that we feel deeply impressed by the singularity of the appearance, which to me is inexplicable by any hypothesis of fortuitous coincidence. If the evidence of condensation into stars rested alone upon that shown in this photograph it would be almost irresistible, but when we turn to re-examine and compare the photographs of M 81 *Ursæ Majoris* and M 31 *Andromedæ*, which have been presented to the Society, we find corroborative evidence that amounts, I submit, to a demonstration that we now see in various stages of progress the evolution of stellar systems corresponding with our ideas of the early state of the solar system.

The photograph is placed in the Library.

* *Mem. R.A.S.*, vol. xxxvi. pl. 6, fig. 27.

Observations of the Planet Iris and Comparison Stars, made with the Transit Circle of the Radcliffe Observatory, Oxford, during the Opposition of 1888.

(*Communicated by E. J. Stone, M.A., F.R.S., Radcliffe Observer.*)

Observations of the Planet Iris.

[The N.P.D.'s are corrected for Refraction but not for Parallax.]

Greenwich Mean Time of Observation.	Observer.	Apparent Places. R.A.	N.P.D.	Observer's Remarks.
1888. h m s		h m s	° ′ ″	
Oct. 15 12 54 13	R.	2 29 5·35	66 15 17·78	
17 12 45 3	R.	2 27 46·22	66 25 19·46	Faint at times; cloudy.
19 12 35 47	R.	2 26 22·16	66 36 23·76	Very diffused.
20 12 31 8	F. B.	2 25 38·46	66 42 19·07	Bad image.
22 12 21 46	R.	2 24 8·30	66 54 57·88	Diffused and unsteady; foggy.
23 12 17 4	F. B.	2 23 22·06	67 1 38·88	Diffused and faint; foggy.
30 11 43 58	F. B.	2 17 46·35	67 54 31·03	Magnitude 7–6.
Nov. 13 10 38 44	F. B.	2 7 33·21	69 59 4·47	Magnitude 7 or 7–6.
16 10 25 16	F. B.	2 5 53·22	70 26 6·87	Magnitude 7 or 7–8. Diffused.
17 10 20 50	R.	2 5 23·28	70 34 59·66	Very faint; doubtful observation in N.P.D. Cloudy.
21 10 3 26	R.	2 3 42·12	71 9 28·81	
22 9 59 9	F. B.	2 3 21·61	71 17 48·35	Magnitude 7 or 7–8.
26 9 42 25	R.	2 2 20·48	71 49 29·81	Magnitude 7–8.
27 9 38 19	F. B.	2 2 10·56	71 56 59·07	Magnitude 7–8.
30 9 26 14	R.	2 1 53·42	72 18 21·92	Very faint; observation of little value; cloudy.
Dec. 1 9 22 17	F. B.	2 1 52·35	72 25 3·66	About ½ Mag. fainter than Arg. Z. + 17°, 315.
6 9 3 6	F. B.	2 2 20·39	72 55 16·15	Very faint; thick haze.
12 8 41 17	R.	2 4 7·19	73 23 52·92	

Observations of the Comparison Stars Observed with Iris.

Separate Results.

Day.	Observer.	Obs. Mag.	Mean R.A. 1888 Jan. 1.	Mean N.P.D. 1888 Jan. 1.	Notes.
			Arg. Z. + 17°, 307.		
1888.			h m s	° ′ ″	
Nov. 16	F. B.	6	1 57 34·03	72 17 7·27	Red star.
22	F. B.	6	34·00	7·70	Reddish.
27	F. B.	6	33·95	5·97	
		6	1 57 33·98	72 17 6·98	
			Arg. Z. + 17°, 315.		
Nov. 30	R.		2 1 36·95	72 30 15·45	
Dec. 1	F. B.		...	15·12	
22	F. B.	8	37·02	15·42	
		8	2 1 36·99	72 30 15·33	
			Arg. Z. + 16°, 247.		
Dec. 6	F. B.		...	73 18 2·66	
12	R.		2 3 14·07	3 60	
18	R.		14·02	4·03	
26	F. B.	7–6	13·83	4·85	
		7–6	2 3 13·97	73 18 3·79	
			Arg. Z. + 19°, 329.		
Nov. 16	F. B.	$7\frac{1}{2}$	...	70 10 57·08	Double; $7\frac{1}{2}$ and $9\frac{1}{2}$ or 10–9 Magnitudes.
17	R.		...	57·99	
1889.					
Jan. 1	R.		2 3 29·95	...	
		7–8	2 3 29·95	70 10 57·54	
			Arg. Z. + 18°, 277.		
1888.					
Nov. 21	R.		2 4 25·14	71 1 42·39	
22	F. B.	6–7	25·01	42·83	
		6–7	2 4 25·08	71 1 42·61	
			Arg. Z. + 20°, 341.		
Nov. 13	F. B.		2 5 6·07	69 9 1·59	

Day.	Observer.	Obs. Mag.	Mean R.A. 1888 Jan. 1.	Mean N.P.D. 1888 Jan. 1.	Notes.
			Arg. Z. + 21°, 298.		
1889.			h m s	° ′ ″	
Jan. 1	R.		2 6 2·98	68 32 33·73	
			Arg. Z. + 20°, 348 (*η Arietis*).		
1888.					
Nov. 27	F. B.	6–5	2 6 31·92	69 18 54·83	
Dec. 6	F. B.		31·90	54·44	
28	R.		31·84	56·11	
		6–5	2 6 31·89	69 18 55·13	
			Arg. Z. + 21°, 317.		
Dec. 12	R.		2 11 26·14	67 51 25·61	Estimation of Mag. Dec. 22 = 9–8.
18	R.		26·20	26·93	
		9 8	2 11 26·17	67 51 26·27	
			Arg. Z. + 19°, 340 (*θ Arietis*).		
Oct. 23	F. B.		2 11 53·70	70 37 1·77	
Nov. 13	F. B.	5–6	53·74	2·92	
20	F. B.	5½	53·78	1·26	
22	F. B.	5½	53·92	2·43	3 wires only in R.A. "Good."
Dec. 6	F. B.		53·77	1·59	
7	R.		53·74	2·52	
		5–6	2 11 53·77	70 37 2·08	
			Arg. Z. + 21°, 321.		
Dec. 22	F. B.	8	2 12 16·77	68 37 10·03	A star follows (Arg. Z. + 21, 322) 9 or 9–8 Mag.
26	F. B.	8–7	16·83	10·10	
		8	2 12 16·80	68 37 10·07	
			Arg. Z. + 22°, 329.		
1889.					
Jan. 1	R.		2 12 38·61	67 20 57·78	
			Arg. Z. + 19°, 346.		
1888.					
Nov. 16	F. B.	9	2 14 17·95	70 23 25·28	Very faint.
27	F. B.	9	17·97	23·11	Very faint.
		9	2 14 17·96	70 23 24·20	

Day.	Observer.	Obs. Mag.	Mean R.A. 1888 Jan. 1.	Mean N.P.D. 1888 Jan. 1.	Notes.
			Arg. Z. + 22°, 331.		
1888.			h m s	° ′ ″	
Oct. 19	R.		2 14 53·90	67 5 11·00	
30	F. B.	7–8	53·90	11·14	
Nov. 21	R.		53·98	11·69	
		7–8	2 14 53·93	67 5 11·28	
			Arg. Z. + 20°, 388.		
Dec. 12	R.	9–8	2 17 30·03	69 5 40·63	
			Arg. Z. + 22°, 347.		
Nov. 22	F. B.	8–7	2 20 37·91	67 37 33·19	
Dec. 22	F. B.	8–7	37·99	32·31	
		8–7	2 20 37·95	67 37 32·75	
			Arg. Z. + 23°, 326.		
Oct. 20	F. B.		...	65 52 13·48	
1889.					
Jan. 1	R.		2 21 53·45	15·21	
			2 21 53·45	65 52 14·35	
			Arg. Z. + 22°, 354.		
1888.					
Oct. 22	R.		2 22 50·55	67 1 51·32	
23	F. B.		50·61	52·03	
Nov. 27	F. B.	6	50·58	52·40	
30	R.		50·63	53·60	
		6	2 22 50·59	67 1 52·45	
			Arg. Z. + 20°, 404.		
Oct. 30	F. B.	8–7	2 22 57·71	68 54 21·90	
Dec. 26	F. B.	8	57·59	21·02	
		8	2 22 57·65	68 54 21·46	
			Arg. Z. + 24°, 358.		
Oct. 15	R.		2 24 5·75	65 15 41·99	Estimation of Mag. Dec. 22 = 6–5.
17	R.		...	42·53	
19	R.		5·83	42·70	
1889.					
Jan. 7	W.		5·82	42·34	
		6–5	2 24 5·80	65 15 42·39	

Day.	Observer.	Obs. Mag.	Mean R.A. 1888 Jan. 1.	Mean N.P.D. 1888 Jan. 1.	Notes.
			Arg. Z. + 21°, 349.		
1888.			h m s	° ′ ″	
Nov. 13	F. B.	7½	2 26 1·78	68 9 43·39	
20	F. B.	8–7	1·78	41·27	
22	F. B.	7½	1·75	42·91	
		8–7	2 26 1·77	68 9 42·52	
			Arg. Z. + 24°, 369.		
Nov. 26	R.	8	2 28 11·79	65 35 55·67	
Dec. 12	R.	8	11·81	54·71	
13	F. B.		...	55·07	
26	F. B.	8–9	11·89	54·21	
		8	2 28 11·83	65 35 54·92	
			Arg. Z. + 22°, 368.		
Oct. 20	F. B.		2 28 16·68	67 31 24·62	
Nov. 27	F. B.	8–9	16·65	22·02	
Dec. 22	F. B.	9–8	16·59	24·21	
		9–8	2 28 16·64	67 31 23·62	
			Arg. Z. + 22°, 372.		
Oct. 17	R.		...	67 26 10·86	
19	R.		2 30 18·74	10·41	
Nov. 22	F. B.	8	18·67	11·08	
		8	2 30 18·70	67 26 10·78	
			Arg. Z. + 24°, 376.		
1889. Jan. 1	R.		2 30 33·05	65 50 26·13	Second and brighter of two stars observed.
			Arg. Z. + 22°, 375.		
1888. Nov. 13	F. B.	8–9	2 31 25·36	67 21 25·99	
20	F. B.	8–9	25·39	24·59	
		8–9	2 31 25·38	67 21 25·29	

Mean Places of Iris Comparison Stars.

Star's Name.	Mag.	Mean R.A. 1888, Jan. 1.	No. of Obs. in R.A.	Mean N.P.D. 1888, Jan. 1.	No. of Obs. in N.P.D.
		h m s		° ′ ″	
Arg. Z. +17°307	7·0	1 57 33·98	3	72 17 6·98	3
+17·315	7·3	2 1 36·99	2	72 30 15·33	3
+16·247	6·8	2 3 13·97	3	73 18 3·79	4
+19·329	7·5	2 3 29·95	1	70 10 57·54	2
+18·277	6·0	2 4 25·08	2	71 1 42·61	2
+20·341	7·5	2 5 6·07	1	69 9 1·59	1
+21·298	8·5	2 6 2·98	1	68 32 33·73	1
+20·348	5·5	2 6 31·89	3	69 18 55·13	3
+21·317	8·3	2 11 26·17	2	67 51 26·27	2
+19·340	6·0	2 11 53·77	6	70 37 2·08	6
+21·321	8·0	2 12 16·80	2	68 37 10·07	2
+22·329	6·0	2 12 38·61	1	67 20 57·78	1
+19·346	8·5	2 14 17·96	2	70 23 24·20	2
+22·331	7·8	2 14 53·93	3	67 5 11·28	3
+20·388	8·5	2 17 30·03	1	69 5 40·63	1
+22·347	7·8	2 20 37·95	2	67 37 32·75	2
+23·326	8·6	2 21 53·45	1	65 52 14·35	2
+22·354	6·0	2 22 50·59	4	67 1 52·45	4
+20·404	7·5	2 22 57·65	2	68 54 21·46	2
+24·358	6·2	2 24 5·80	3	65 15 42·39	4
+21·349	8·0	2 26 1·77	3	68 9 42·52	3
+24·369	8·2	2 28 11·83	3	65 35 54·92	4
+22·368	8·1	2 28 16·64	3	67 31 23·62	3
+22·372	7·6	2 30 18·70	2	67 26 10·78	3
+24·376	7·0	2 30 33·05	1	65 50 26·13	1
+22·375	8·3	2 31 25·38	2	67 21 25·29	2

Observers: W.—Mr. W. Wickham; R.—Mr. W. H. Robinson; F. B.—Mr. F. A. Bellamy.

Radcliffe Observatory, Oxford:
1889, *May* 9.

Ephemeris for Physical Observations of the Moon. By A. Marth.

1889 *July* 1 *to* 1890 *January* 1.

(Continued from p. 140.)

Greenwich Noon.	Selenographical Colong. of the Sun.	Selenographical Lat. of the Sun.	Sel. Long. of the Earth.	Sel. Lat. of the Earth.	Geocentric Libration, Amount.	Direction.
1889.	°	°	°	°	°	°
July 1	309·27	−0·08	−4·93	−3·61	6·11	126·3
2	321·52	0·05	5·92	4·77	7·59	129·0
3	333·76	−0·03	6·68	5·71	8·78	130·7
4	345·99	+0·00	7·17	6·39	9·59	131·9
5	358·22	+0·03	7·34	6·77	9·97	132·9
6	10·45	0·05	7·14	6·80	9·85	133·8
7	22·66	+0·08	−6·57	−6·45	9·19	134·7
8	34·87	0·11	5·60	5·70	7·99	135·7
9	47·07	0·14	4·28	4·58	6·27	137·0
10	59·27	0·17	2·67	3·13	4·11	139·6
11	71·47	0·20	−0·86	−1·45	1·68	149·4
12	83·66	0·23	+1·04	+0·35	1·09	288·6
13	95·85	0·26	2·87	2·11	3·56	306·4
14	108·04	+0·29	+4·52	+3·71	5·84	309·5
15	120·23	0·32	5·85	5·03	7·71	310·8
16	132·43	0·35	6·81	6·00	9·06	311·6
17	144·63	0·38	7·33	6·59	9·84	312·2
18	156·84	0·41	7·41	6·81	10·05	312·8
19	169·06	0·43	7·09	6·68	9·73	313·5
20	181·28	0·46	6·40	6·24	8·93	314·4
21	193·51	+0·48	+5·43	+5·52	7·74	315·6
22	205·74	0·50	4·24	4·57	6·23	317·2
23	217·98	0·53	2·90	3·44	4·49	319·9
24	230·22	0·55	1·49	2·15	2·62	325·4
25	242·46	0·57	+0·07	+0·79	0·79	354·8
26	254·71	0·59	−1·29	−0·62	1·44	115·7
27	256·96	0·61	2·56	2·01	3·25	128·2

Greenwich Noon.	Selenographical Colong. of the Sun.	Lat. of the Sun.	Sel. Long. of the Earth.	Lat. of the Earth.	Geocentric Libration. Amount.	Direction.
1889.	°	°	°	°	°	°
July 28	279·21	+0·63	−3·67	−3·33	4·96	132·2
29	291·46	0·66	4·62	4·50	6·45	134·4
30	303·71	0·68	5·35	5·49	7·66	135·8
31	315·95	0·70	5·87	6·22	8·54	136·8
Aug. 1	328·19	0·72	6·15	6·65	9·05	137·4
2	340·42	0·75	6·17	6·75	9·14	137·8
3	352·65	0·77	5·93	6·49	8·78	137·7
4	4·87	+0·80	−5·42	−5·86	7·97	137·3
5	17·09	0·82	4·64	4·87	6·72	136·5
6	29·29	0·85	3·59	3·56	5·06	134·8
7	41·49	0·87	2·31	2·01	3·06	131·1
8	53·69	0·90	−0·84	−0·31	0·90	110·2
9	65·88	0·92	+0·74	+1·43	1·60	333·2
10	78·06	0·95	2·34	3·06	3·85	322·7
11	90·24	+0·97	+3·83	+4·48	5·89	319·6
12	102·42	1·00	5·11	5·59	7·57	317·7
13	114·61	1·02	6·07	6·33	8·76	316·4
14	126·80	1·04	6·64	6·67	9·40	315·4
15	139·00	1·06	6·77	6·66	9·49	314·7
16	151·20	1·08	6·49	6·28	9·02	314·2
17	163·40	1·10	5·84	5·62	8·10	314·1
18	175·61	+1·12	+4·86	+4·72	6·77	314·3
19	187·83	1·13	3·65	3·63	5·15	314·8
20	200·05	1·15	2·30	2·39	3·31	316·1
21	212·27	1·16	+0·88	+1·05	1·38	320·1
22	224·50	1·18	−0·51	−0·33	0·60	122·8
23	236·74	1·19	1·79	1·70	2·47	133·5
24	248·97	1·21	2·91	3·02	4·19	136·0
25	261·21	+1·22	−3·82	−4·21	5·69	137·8
26	273·45	1·23	4·49	5·23	6·88	139·5
27	285·69	1·25	4·90	6·00	7·74	140·9
28	297·93	1·26	5·07	6·48	8·22	142·1
29	310·17	1·28	5·00	6·62	8·29	143·1
30	322·40	1·29	4·73	6·41	7·96	143·7
31	334·62	1·31	4·29	5·83	7·24	143·7

Greenwich Noon.	Selenographical Colong. of the Sun.	Selenographical Lat. of the Sun.	Sel. Long. of the Earth.	Sel. Lat. of the Earth.	Geocentric Libration. Amount.	Direction.
1889.	°	°	°	°	°	°
Sept. 1	346·84	+1·32	−3·69	−4·92	6·14	143·2
2	359·06	1·34	2·95	3·70	4·73	141·5
3	11·26	1·35	2·07	2·25	3·06	137·3
4	23·46	1·37	−1·07	−0·64	1·25	120·2
5	35·65	1·39	+0·03	+1·02	1·02	358·5
6	47·83	1·40	1·22	2·61	2·88	334·9
7	60·01	1·41	2·43	4·04	4·72	329·1
8	72·18	+1·43	+3·58	+5·21	6·32	325·6
9	84·36	1·44	4·58	6·04	7·57	322·9
10	96·53	1·45	5·34	6·49	8·39	320·8
11	108·70	1·46	5·78	6·56	8·74	318·8
12	120·87	1·47	5·86	6·28	8·57	317·2
13	133·05	1·48	5·54	5·68	7·93	315·8
14	145·23	1·48	4·87	4·82	6·85	314·8
15	157·42	+1·49	+3·89	+3·75	5·40	314·0
16	169·61	1·49	2·68	2·54	3·69	313·6
17	181·81	1·50	+1·32	+1·23	1·80	313·2
18	194·01	1·50	−0·09	−0·12	0·15	143·0
19	206·22	1·50	1·45	1·48	2·07	135·5
20	218·44	1·51	2·68	2·78	3·86	136·1
21	230·66	1·51	3·69	3·98	5·42	137·2
22	242·88	+1·51	−4·42	−5·01	6·68	138·7
23	255·10	1·51	4·83	5·82	7·56	140·4
24	267·33	1·52	4·92	6·35	8·03	142·4
25	279·55	1·52	4·70	6·54	8·05	144·4
26	291·78	1·52	4·23	6·37	7·64	146·6
27	304·00	1·52	3·55	5·83	6·82	148·8
28	316·22	1·53	2·75	4·93	5·65	151·0
29	328·43	+1·53	−1·88	−3·73	4·18	153·3
30	340·64	1·53	0·98	2·30	2·50	157·0
Oct. 1	352·84	1·53	−0·08	−0·73	0·73	173·4
2	5·03	1·54	+0·80	+0·89	1·02	318·0
3	17·21	1·54	1·68	2·46	2·97	325·7
4	29·39	1·54	2·53	3·86	4·62	326·8
5	41·56	1·54	3·34	5·03	6·04	326·5

Greenwich Noon.	Selenographical Colong. of the Sun.	Lat. of the Sun.	Sel. Long. of the Earth.	Lat. of the Earth.	Geocentric Libration. Amount.	Direction.
1889.	°	°	°	°	°	°
Oct. 6	53·72	+1·54	+4·07	+5·89	7·16	325·5
7	65·88	1·54	4·67	6·40	7·92	324·1
8	78·04	1·53	5·07	6·54	8·27	322·4
9	90·19	1·53	5·21	6·32	8·19	320·6
10	102·35	1·53	5·06	5·77	7·68	318·9
11	114·51	1·52	4·60	4·95	6·76	317·2
12	126·67	1·51	3·83	3·90	5·47	315·6
13	138·83	+1·50	+2·80	+2·70	3·89	314·0
14	151·00	1·49	1·56	1·39	2·08	311·8
15	163·17	1·48	+0·18	+0·03	0·18	279·6
16	175·35	1·47	−1·24	−1·33	1·82	137·2
17	187·54	1·46	2·60	2·63	3·69	135·4
18	199·73	1·44	3·81	3·83	5·40	135·3
19	211·92	1·43	4·77	4·89	6·83	135·8
20	224·12	+1·42	−5·42	−5·73	7·88	136·7
21	236·32	1·41	5·70	6·31	8·50	138·1
22	248·53	1·40	5·58	6·58	8·62	139·9
23	260·74	1·39	5·07	6·48	8·22	142·1
24	272·95	1·38	4·23	6·00	7·34	144·9
25	285·16	1·37	3·14	5·14	6·02	148·6
26	297·37	1·36	1·91	3·94	4·38	154·2
27	309·57	+1·35	−0·63	−2·48	2·56	165·9
28	321·77	1·34	+0·62	−0·86	1·06	215·5
29	333·96	1·33	1·76	+0·80	1·93	294·6
30	346·15	1·32	2·77	2·40	3·66	311·0
31	358·33	1·30	3·62	3·84	5·27	316·8
Nov. 1	10·50	1·29	4·32	5·03	6·63	319·5
2	22·67	1·28	4·86	5·92	7·65	320·8
3	34·83	+1·26	+5·23	+6·46	8·30	321·2
4	46·98	1·25	5·42	6·64	8·56	321·0
5	59·12	1·23	5·40	6·47	8·42	320·3
6	71·27	1·21	5·17	5·97	7·89	319·2
7	83·41	1·19	4·70	5·18	6·99	317·9
8	95·55	1·17	3·99	4·15	5·75	316·2
9	107·69	1·15	3·05	2·94	4·23	314·0

Greenwich Noon.	Selenographical Colong. of the Sun.	Lat of the Sun.	Sel. Long. of the Earth.	Lat. of the Earth.	Geocentric Libration. Amount.	Direction.
1889.	°	°	°	°	°	°
Nov. 10	119·83	+1·13	+1·90	+1·62	2·50	310·4
11	131·98	1·10	+0·60	+0·24	0·81	291·6
12	144·13	1·08	−0·80	−1·14	1·40	144·9
13	156·28	1·05	2·23	2·48	3·33	138·0
14	168·44	1·03	3·60	3·71	5·17	135·9
15	180·61	1·01	4·82	4·79	6·80	134·9
16	192·78	0·99	5·81	5·68	8·12	134·5
17	204·95	+0·96	−6·49	−6·33	9·05	134·5
18	217·13	0·94	6·77	6·68	9·50	134·8
19	229·32	0·92	6·63	6·69	9·41	135·5
20	241·51	0·90	6·04	6·32	8·74	136·5
21	253·71	0·88	5·04	5·58	7·51	138·0
22	265·91	0·86	3·70	4·43	5·77	140·2
23	278·11	0·84	2·12	2·99	3·66	144·7
24	290·31	+0·82	−0·43	−1·32	1·39	161·8
25	302·50	0·79	+1·24	+0·43	1·31	289·1
26	314·69	0·77	2·78	2·14	3·51	307·7
27	326·87	0·75	4·11	3·69	5·52	312·0
28	339·05	0·73	5·18	4·98	7·18	314·0
29	351·22	0·71	5·95	5·94	8·40	315·1
30	3·38	0·68	6·42	6·55	9·16	315·7
Dec. 1	15·54	+0·66	+6·60	+6·78	9·45	316·0
2	27·69	0·63	6·51	6·66	9·30	315·8
3	39·83	0·60	6·16	6·20	8·73	315·5
4	51·97	0·57	5·58	5·45	7·79	314·5
5	64·10	0·54	4·78	4·45	6·53	313·1
6	76·23	0·51	3·79	3·27	5·01	310·8
7	88·36	0·48	2·65	1·94	3·29	306·3
8	100·49	+0·45	+1·37	+0·55	1·48	291·9
9	112·63	0·42	0·00	−0·86	0·86	180·2
10	124·76	0·39	−1·41	2·23	2·64	147·7
11	136·90	0·36	2·82	3·50	4·50	141·2
12	149·04	0·33	4·16	4·63	6·23	138·1
13	161·18	0·30	5·37	5·57	7·74	136·2
14	173·33	0·27	6·38	6·28	8·94	134·7

Greenwich Noon.	Selenographical Colong. of the Sun.	Lat. of the Sun.	Sel. Long. of the Earth.	Lat. of the Earth.	Geocentric Libration. Amount.	Direction.
1889.	°	°	°	°	°	°
Dec. 15	185·49	+0·24	−7·11	−6·71	9·77	133·6
16	197·66	0·21	7·49	6·83	10·12	132·6
17	209·83	0·18	7·47	6·60	9·96	131·6
18	222·00	0·16	7·02	5·99	9·22	130·7
19	234·18	0·13	6·11	5·01	7·90	129·5
20	246·37	0·11	4·80	3·69	6·05	127·6
21	258·56	0·08	3·14	2·09	3·77	123·6
22	270·75	+0·06	−1·26	−0·31	1·29	104·1
23	282·94	0·03	+0·72	+1·49	1·66	334·2
24	295·13	+0·01	2·63	3·18	4·13	320·4
25	307·32	−0·02	4·35	4·64	6·35	316·9
26	319·50	0·04	5·76	5·75	8·13	315·1
27	331·67	0·07	6·78	6·48	9·37	313·9
28	343·84	0·10	7·39	6·81	10·04	312·9
29	356·00	−0·13	+7·59	+6·76	10·15	311·9
30	8·16	0·16	7·40	6·36	9·75	310·9
31	20·31	0·19	6·87	5·66	8·90	309·7
1890 Jan. 1	32·45	−0·22	6·06	4·71	7·67	308·0

Errata in Gen. Tennant's paper, Vol. XLIX. No. 5.

Page 280, 8th line from bottom, *for* "fourth volume" *read* "second volume."
„ 280, last line, *for* $a + bt^2_{\frac{1}{2}}$ *read* $a + bt$.
„ 282, 15th line from bottom, *for* "value of e" *read* "value of c."